

2009 Mississippi Curriculum Framework

Postsecondary Cardiovascular Technology

(Program CIP: 51.0901 – Cardiovascular Technology)

Direct inquiries to

Shawn Mackey
Director for Career and Technical Education
State Board for Community and Junior Colleges
3825 Ridgewood Road
Jackson, MS 39211
(601) 432-6518
smackey@sbcjc.cc.ms.us

Charlotte Darnell
Instructional Design Specialist
Research and Curriculum Unit
P.O. Drawer DX
Mississippi State, MS 39762
(662) 325-2510
jdarn10@bellsouth.net

Additional copies

Research and Curriculum Unit for Workforce Development
Vocational and Technical Education
Attention: Reference Room and Media Center Coordinator
P.O. Drawer DX
Mississippi State, MS 39762
<http://cia.rcu.msstate.edu/curriculum/download.asp>
(662) 325-2510

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Charlotte Darnell, Author
Jolanda Harris, Educational Technologist
Ashleigh Barbee Murdock, Editor
Robin Parker, Curriculum Coordinator

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Acknowledgments

Writing Team

Cynthia Stanford-Means, Northwest Community College,
DeSoto Center, Southaven, MS
Richard Stevens, Northwest Community College, DeSoto
Center, Southaven, MS

**Professional Curriculum
Advisory Team**

Cardiovascular Technology Advisory Committee,
Northwest Community College

Standards in this document are based on information from the following organizations:

**Standards and Guidelines for
Cardiovascular Technology
Programs**

Cardiovascular Credentialing International (CCI),
Registered Cardiovascular Invasive Specialist Exam
(RCIS) Outline, 2008

Related Academic Standards

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Preface

Cardiovascular Technology Research Synopsis

Articles, books, Web sites, and other materials listed at the end of each course were considered during the revision process. Specific journals, articles, and resources were especially useful in providing insight into trends and issues in the field. These references are suggested for use by instructors and students during the study of the topics outlined.

Industry advisory team members from the college were asked to give input related to changes to be made to the curriculum framework. Specific comments related to soft skills needed in this program included accountability, communication skills, adequate cognitive skills as well as compassion, punctuality, respect for peers in any field, goal oriented, self motivated, eager to learn new things, positive attitude, dependability, team player attitude, flexibility, and good work ethic. Occupational-specific skills stated included technically sound hand-eye coordination, sound reasoning and problem-solving skills, ability to readily adapt to changing technologies and protocols, computer skills, and ability to retain information. Safety practices emphasized included patient safety, radiation safety, wearing appropriate protective gear during medical procedures, adhering to standard precautions, following OSHA and HIPPA guidelines, and ergonomics.

Instructors from colleges were also asked to give input on changes to be made to the curriculum framework. Specific comments related to this program included statements from advisory committee members to delete or resequence Clinical III to allow students to finish the program in May. Changes suggested for the curriculum included the following: Add Business Communication, BOA 2613; delete Cardiovascular Technology as a Professional, CTV 2812; delete Survey of Physics I, PHY 1213; and change the sequence of Cardiovascular Clinical I, II, and III.

Curriculum

The following national standards were referenced in each course of the curriculum:

- CTB/McGraw-Hill LLC *Tests of Adult Basic Education, Forms 7 and 8 Academic Standards*
- *21st Century Skills*
- *The Cardiovascular Credentialing International (CCI), Registered Cardiovascular Invasive Specialist (RCIS), Examination Outline*

Industry and instructor comments, along with current research, were considered by the curriculum revision team during the revision process, and changes were made as needed and appropriate. Many of the skills and topics noted in the research were already included in the curriculum framework. Specific changes made to the curriculum at the September 5, 2008, curriculum revision meeting included the following:

- Competencies and objectives were reviewed to ensure accuracy and appropriateness.
- Competencies and objectives related to the revised standards for an accredited educational program were added or changed.

- Delete Cardiovascular Technology as a Professional, CVT 2812; information in this course will be included in Foundations of Cardiovascular Technology, CVT 1113, and in Business Communications, BOA 2613.
- Add Business Communications, BOA 2613.
- Delete Survey of Physics I, PHY 1213; competencies in this course will be incorporated into Cardiovascular Anatomy and Physiology, CVT 1214.
- The courses, Invasive Cardiology I, Invasive Cardiology II, Non-Invasive Cardiology I, and Non-Invasive Cardiology II were each changed from 3-sch courses to 4-sch courses.
- The math elective was changed to specifically include College Algebra, MAT 1313.
- The course Cardiovascular Clinical I, CVT 2718, was changed from an 8-sch course to a 6-sch course; the course Cardiovascular Clinical III, (CVT 2736) was changed from 6 sch to 8 sch.
- The following changes in course sequence were made: Introduction to Computer Concepts, CSC 1113 was moved from First Year, Summer Term to Second Year, Fall Semester; Cardiovascular Clinical I, CVT 2718 was moved from Second Year, Fall Semester, to First Year, Summer Term; Cardiovascular Clinical II, CVT 2728 was moved from Second Year, Spring Semester, to Second Year, Fall Semester; and Cardiovascular Clinical III, CVT 2736 was moved from Second Year, Summer Term, to Second Year, Spring Semester. This change in course sequence eliminated the Second Year, Summer Term.
- The reference list was updated.
- The Recommended Tools and Equipment list was updated.

Assessment

Students will be assessed using the Cardiovascular Credentialing International (CCI), Registered Cardiovascular Invasive Specialist (RCIS) Exam.

Professional Learning

It is suggested that instructors participate in professional learning related to the following concepts:

- How to use the program Blackboard site
- Differentiated instruction – To learn more about differentiated instruction, please go to http://www.paec.org/teacher2teacher/additional_subjects.html and click on Differentiated Instruction. Work through this online course, and review the additional resources.

Articulation

No articulated credit will be offered upon implementation of this curriculum by the college.

Foreword

As the world economy continues to evolve, businesses and industries must adopt new practices and processes in order to survive. Quality and cost control, work teams and participatory management, and an infusion of technology are transforming the way people work and do business. Employees are now expected to read, write, and communicate effectively; think creatively, solve problems, and make decisions; and interact with each other and the technologies in the workplace. Vocational-technical programs must also adopt these practices in order to provide graduates who can enter and advance in the changing work world.

The curriculum framework in this document reflects these changes in the workplace and a number of other factors that impact on local vocational-technical programs. Federal and state legislation calls for articulation between high school and community college programs, integration of academic and vocational skills, and the development of sequential courses of study that provide students with the optimum educational path for achieving successful employment. National skills standards, developed by industry groups and sponsored by the U.S. Department of Education and Labor, provide vocational educators with the expectations of employers across the United States. All of these factors are reflected in the framework found in this document.

Referenced throughout the courses of the curriculum are the 21st Century Skills, which were developed by the Partnership for 21st Century Skills, a group of business and education organizations concerned about the gap between the knowledge and skills learned in school and those needed in communities and the workplace. A portion of the 21st Century Skills addresses learning skills needed in the 21st century, including information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills. The need for these types of skills has been recognized for some time, and the 21st Century Skills is adapted in part from the 1991 report from the U.S. Secretary of Labor's Commission on Achieving Necessary Skills (SCANS). Another important aspect of learning and working in the 21st century involves technology skills, and the International Society for Technology in Education, developers of the National Educational Technology Standards (NETS), were strategic partners in the Partnership for 21st Century Skills.

Each postsecondary program of instruction consists of a program description and a suggested sequence of courses that focus on the development of occupational competencies. Each vocational-technical course in this sequence has been written using a common format that includes the following components:

- Course Name – A common name that will be used by all community/junior colleges in reporting students
- Course Abbreviation – A common abbreviation that will be used by all community/junior colleges in reporting students
- Classification – Courses may be classified as the following:
 - Vocational-technical core – A required vocational-technical course for all students

- Area of concentration (AOC) core – A course required in an area of concentration of a cluster of programs
- Vocational–technical elective – An elective vocational–technical course
- Related academic course – An academic course that provides academic skills and knowledge directly related to the program area
- Academic core – An academic course that is required as part of the requirements for an associate degree
- Description – A short narrative that includes the major purpose(s) of the course and the recommended number of hours of lecture and laboratory activities to be conducted each week during a regular semester
- Prerequisites – A listing of any courses that must be taken prior to or on enrollment in the course
- Corequisites – A listing of courses that may be taken while enrolled in the course
- Competencies and Suggested Objectives – A listing of the competencies (major concepts and performances) and of the suggested student objectives that will enable students to demonstrate mastery of these competencies

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75% of the time allocated to each course. The remaining 25% of each course should be developed at the local district level and may reflect the following:
 - Additional competencies and objectives within the course related to topics not found in the state framework, including activities related to specific needs of industries in the community college district
 - Activities that develop a higher level of mastery on the existing competencies and suggested objectives
 - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed/revised
 - Activities that implement components of the Mississippi Tech Prep initiative, including integration of academic and vocational–technical skills and coursework, school-to-work transition activities, and articulation of secondary and postsecondary vocational–technical programs
 - Individualized learning activities, including work site learning activities, to better prepare individuals in the courses for their chosen occupational areas
- Sequencing of the course within a program is left to the discretion of the local district. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors.

- Programs that offer an Associate of Applied Science degree must include a minimum 15 semester credit hour academic core. Specific courses to be taken within this core are to be determined by the local district. Minimum academic core courses are as follows:

○ 3 semester credit hours	Math/Science Elective
○ 3 semester credit hours	Written Communications Elective
○ 3 semester credit hours	Oral Communications Elective
○ 3 semester credit hours	Humanities/Fine Arts Elective
○ 3 semester credit hours	Social/Behavioral Science Elective

It is recommended that courses in the academic core be spaced out over the entire length of the program so that students complete some academic and vocational-technical courses each semester. Each community/junior college has the discretion to select the actual courses that are required to meet this academic core requirement.

- In instances where secondary programs are directly related to community and junior college programs, competencies and suggested objectives from the high school programs are listed as Baseline Competencies. These competencies and objectives reflect skills and knowledge that are directly related to the community and junior college vocational-technical program. In adopting the curriculum framework, each community and junior college is asked to give assurances that:
 - students who can demonstrate mastery of the Baseline Competencies do not receive duplicate instruction and
 - students who cannot demonstrate mastery of this content will be given the opportunity to do so.
- The roles of the Baseline Competencies are to do the following:
 - Assist community/junior college personnel in developing articulation agreements with high schools
 - Ensure that all community and junior college courses provide a higher level of instruction than their secondary counterparts
- The Baseline Competencies may be taught as special “Introduction” courses for 3–6 semester hours of institutional credit that will not count toward associate degree requirements. Community and junior colleges may choose to integrate the Baseline Competencies into ongoing courses in lieu of offering the “Introduction” courses or may offer the competencies through special projects or individualized instruction methods.
- Technical elective courses have been included to allow community colleges and students to customize programs to meet the needs of industries and employers in their areas.

In order to provide flexibility within the districts, individual courses within a framework may be customized by:

- adding new competencies and suggested objectives;
- revising or extending the suggested objectives for individual competencies;
- integrating baseline competencies from associated high school programs; and

- adjusting the semester credit hours of a course to be up 1 hour or down 1 hour (after informing the State Board for Community and Junior Colleges [SBCJC] of the change).

In addition, the curriculum framework as a whole may be customized by:

- resequencing courses within the suggested course sequence;
- developing and adding a new course that meets specific needs of industries and other clients in the community or junior college district (with SBCJC approval); and
- utilizing the technical elective options in many of the curricula to customize programs.

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Program Description

The Cardiovascular Technology program trains technologists to operate sophisticated equipment in assisting physicians with diagnosing and treating patients with cardiac disease. The primary focus is on invasive cardiology procedures. The technologists are trained to work in a cardiac catheterization laboratory where they prepare patients for and assist the physician with a variety of diagnostic and therapeutic procedures usually performed via radiologically-guided catheters and other instrumentation. Most cardiovascular technologists work in hospital cardiology departments, while some work in cardiologists' offices, cardiac rehabilitation centers, or ambulatory surgery centers. This curriculum was written to meet the Commission on Accreditation of Allied Health Education Programs (CAAHEP) Standards and Guidelines for Cardiovascular Technologists.

Graduates of this 2-year program will be awarded an Associate of Applied Science Degree in Cardiovascular Technology and are eligible to make application to sit for the Cardiovascular Credentialing International (CCI), Registered Cardiovascular Invasive Specialist (RCIS) Exam.

Industry standards are based on the *Cardiovascular Credentialing International (CCI), Registered Cardiovascular Invasive Specialist (RCIS) Examination Outline*.

Suggested Course Sequence* **Cardiovascular Technology**

FIRST YEAR

Prerequisite to admission to the program: Anatomy and Physiology I (With lab)

FALL SEMESTER

3 sch	Social/Behavioral Elective
4 sch	Anatomy and Physiology II (BIO 1523 and 1521)
3 sch	Foundations of Cardiovascular Technology (CVT 1113)
3 sch	College Algebra (MAT 1313)
3 sch	Humanities/Fine Arts Elective
<hr/>	
16 sch	

SPRING SEMESTER

4 sch	Principles of Chemistry (CHE 1313 and 1311)
3 sch	Business Communication (BOA 2613)
4 sch	Cardiovascular Anatomy and Physiology (CVT 1214)
3 sch	Written Communications Elective
2 sch	Cardiovascular Pharmacology (CVT 1312)
<hr/>	
16 sch	

SUMMER TERM

4 sch	Microbiology (BIO 2924 and 2920)
3 sch	Oral Communications Elective
6 sch	Cardiovascular Clinical I (CVT 2716)
<hr/>	
13 sch	

SECOND YEAR

FALL SEMESTER

4 sch Invasive Cardiology I (CVT 2414)
4 sch Non-Invasive Cardiology I (CVT 2614)
8 sch Cardiovascular Clinical II (CVT 2728)
3 sch Introduction to Computer Concepts (CSC 1113)

19 sch

SPRING SEMESTER

4 sch Invasive Cardiology II (CVT 2424)
4 sch Non-Invasive Cardiology II (CVT 2624)
2 sch Critical Care Applications (CVT 2512)
8 sch Cardiovascular Clinical III (CVT 2738)

18 sch

* Students who lack entry-level skills in math, English, science, and so forth will be provided related studies.

Cardiovascular Technology Courses

Course Name: Foundations of Cardiovascular Technology

Course Abbreviation: CTV 1113

Classification: Vocational–Technical Core

Description: This course is designed to introduce the students to the fundamental elements in cardiovascular technology, including terminology, important to the delivery of health care in a safe, efficient, and professional manner. (3 sch: 3-hr lecture)

Prerequisite: Anatomy and Physiology I (BIO 1513) and Anatomy and Physiology Lab I (BIO 1511)

Competencies and Suggested Objectives	
1.	Demonstrate knowledge of the history of cardiovascular technology. <ul style="list-style-type: none"> a. Identify significant events and dates in the development of the profession. b. Identify significant individuals that influenced the development of the profession.
2.	Summarize the roles of the cardiovascular technician. <ul style="list-style-type: none"> a. Identify the roles and responsibilities of the cardiovascular catheterization team. b. Discuss the professional relationships among the roles. c. Discuss responsible participation in a supervisory relationship. d. Explain the importance of professional development and formal continuing education.
3.	Discuss state and national professional organizations, ethics and standards, principles, and guidelines. <ul style="list-style-type: none"> a. Identify the functions and influence of national, state, and local professional associations. b. Identify the methods of promoting cardiovascular technology. c. Discuss ethics and standards as related to the cardiovascular technician including provisions of HIPPA. d. Explain applicable state and federal laws to include the Americans with Disabilities Act and the Vulnerable Adult Act including the role of the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO). e. Discuss on-site rules, regulations, and guidelines affecting cardiovascular technology.
4.	Discuss word components, terms, procedures, abbreviations, and symbols related to cardiovascular technology. <ul style="list-style-type: none"> a. Identify combining forms, suffixes, and prefixes related to the various body systems. b. Use medical terminology correctly including spelling and pronunciation. c. Utilize abbreviations and symbols related to the body systems and physical conditions related to cardiovascular technology. d. Communicate information using medical terms in a clear, concise manner.
5.	Discuss safety measures as related to cardiovascular technology. <ul style="list-style-type: none"> a. Discuss the role of OSHA in the clinical environment. b. Explain Universal Precautions. c. Demonstrate hand-washing procedures.

6. Explain areas of cardiovascular performance of the cardiovascular technician.
a. Define activities of daily procedures.
b. Define work and production activities.
c. Discuss the relationship of each performance area to each other.
d. Discuss the balance of performance areas to the achievement of health and wellness.
7. Demonstrate basic therapeutic communication skills.
a. Identify nonverbal and verbal components of active listening.
b. Explain the dynamics of feedback in interpersonal skills.
8. Discuss equipment in the heart cath lab.
a. Identify the major diagnostic and therapeutic equipment used in the lab.
b. Explain the function of each piece of equipment.
9. Explain lab management responsibilities.
a. List lab management responsibilities.
b. Discuss individual areas of management responsibilities including budget and finance, lab standards, quality assurance, record keeping, and continuing education.
10. Discuss that membership in professional organizations is important.
a. List three professional organizations involving cardiovascular technology.
b. Discuss the merits of the American Heart Association as related to cardiovascular technology.

STANDARDS

Standards and Guidelines for Cardiovascular Programs

Cardiovascular Credentialing International (CCI), Registered Cardiovascular Invasive Specialist (RCIS) Exam Outline, 2008

CVT1	Cardiovascular Anatomy and Physiology
CVT2	Cardiovascular Diseases Pathophysiology
CVT3	Diagnostic Techniques
CVT4	Intervention
CVT7	Equipment and Instrumentation
CVT8	Patient Care and Patient Assessment

Related Academic Standards

R1	Interpret Graphic Information (forms, maps, reference sources)
R2	Words in Context (same and opposite meaning)
R3	Recall Information (details, sequence)
R4	Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5	Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
A1	Numeration (ordering, place value, scientific notation)
A2	Number Theory (ratio, proportion)
A3	Data Interpretation (graph, table, chart, diagram)
A4	Pre-Algebra and Algebra (equations, inequality)

- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
- S3 Structural Unit (root, suffix)

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21st Century Skills

- CS1 Global Awareness
- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Baim, D. S. (2005). *Grossman's cardiac catheterization, angiography, and intervention* (7th ed.). Philadelphia, PA: Lippincott, Williams & Wilkins.

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Course Name: Cardiovascular Anatomy and Physiology

Course Abbreviation: CVT 1214

Classification: Vocational–Technical Core

Description: A study of anatomy and physiology in relation to the practice of cardiovascular technology. (4 sch: 3-hr lecture, 2-hr lab)

Prerequisite: Foundations of Cardiovascular Technology (CVT 1113)

Competencies and Suggested Objectives	
1.	Discuss the functions and major components of the circulatory system. <ul style="list-style-type: none"> a. Describe the functions of the circulatory system. b. Describe the major components of the circulatory system. c. Describe regulatory mechanisms that affect the circulatory system. e. Describe how endocrine and neurological system activity affects the circulatory system, especially heart rate and blood pressure.
2.	Explain the development of the cardiovascular system. <ul style="list-style-type: none"> a. Review development of fetal circulation. b. Describe how abnormal fetal circulatory development affects the postnatal circulatory function.
3.	Discuss the components of blood. <ul style="list-style-type: none"> a. List the different types of formed elements of blood. b. Describe the origin and function of erythrocytes, leukocytes, and thrombocytes. c. List the different types of substances present in plasma.
4.	Describe the heart and its functions. <ul style="list-style-type: none"> a. Describe the location of the heart in relationship to other organs of the thoracic cavity and their associated serous membranes. b. Describe the structure and functions of the three layers of the heart wall. c. Identify the chambers, valves, and associated vessels of the heart. d. Trace the flow of blood through the heart, and distinguish between the pulmonary and systemic circulations. e. Describe the location of the parts of the conduction system of the heart, and trace the pathway of impulse initiation and conduction. f. Discuss general electrical theory as it applies to cardiac electrical function.
5.	Describe the functions of the blood vessels. <ul style="list-style-type: none"> a. Describe the structure, size, and function of arteries, capillaries, and veins. b. Explain why capillaries are considered the functional units of the circulatory system. c. Discuss fluid dynamics as they apply to pressure, flow, and cardiovascular system.
6.	Discuss the principal arteries of the body. <ul style="list-style-type: none"> a. List the arterial branches of the ascending aorta and aortic arch. b. Describe the arterial supply to the brain. c. Describe the arterial pathways that supply the upper extremities. d. Describe the major arteries to the thorax, abdomen, and lower extremities.
7.	Explain the principal veins of the body.

<ul style="list-style-type: none"> a. Describe the venous drainage of the head, neck, and upper extremities. b. Describe the venous drainage for the thorax, lower extremities, and abdominal region. c. Describe the vessels involved in the hepatic portal system.
<ul style="list-style-type: none"> 8. Discuss cardiovascular disease clinical considerations. <ul style="list-style-type: none"> a. Give several examples of cardiac arrhythmias and their clinical significance. b. Define ventricular fibrillation, its clinical significance, and forms of treatment. c. Assess the clinical significance of data obtained through blood analysis.

STANDARDS

Standards and Guidelines for Cardiovascular Programs

Cardiovascular Credentialing International (CCI), Registered Cardiovascular Invasive Specialist (RCIS) Exam Outline, 2008

CVT1	Cardiovascular Anatomy and Physiology
CVT2	Cardiovascular Diseases Pathophysiology
CVT3	Diagnostic Techniques
CVT4	Intervention
CVT5	Hemodynamic Data
CVT6	Pharmacology
CVT7	Equipment and Instrumentation
CVT8	Patient Care and Patient Assessment

Related Academic Standards

R1	Interpret Graphic Information (forms, maps, reference sources)
R2	Words in Context (same and opposite meaning)
R3	Recall Information (details, sequence)
R4	Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5	Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1	Addition of Whole Numbers (no regrouping, regrouping)
M2	Subtraction of Whole Numbers (no regrouping, regrouping)
M3	Multiplication of Whole Numbers (no regrouping, regrouping)
M4	Division of Whole Numbers (no remainder, remainder)
M5	Decimals (addition, subtraction, multiplication, division)
M6	Fractions (addition, subtraction, multiplication, division)
M7	Integers (addition, subtraction, multiplication, division)
M8	Percents
M9	Algebraic Operations
A1	Numeration (ordering, place value, scientific notation)
A2	Number Theory (ratio, proportion)
A3	Data Interpretation (graph, table, chart, diagram)
A4	Pre-Algebra and Algebra (equations, inequality)
A5	Measurement (money, time, temperature, length, area, volume)

- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject-verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
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- S3 Structural Unit (root, suffix)

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21st Century Skills

- CS1 Global Awareness
- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

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Course Name: Cardiovascular Pharmacology

Course Abbreviation: CVT 1312

Classification: Vocational–Technical Core

Description: This course is designed to provide the students with the pharmacology needed to function in clinical experiences. This includes classifications of medications, modes of action, indications, contraindications, and their effect on cardiac output and its determinates. (2 sch: 2-hr lecture)

Prerequisite: Foundations of Cardiovascular Technology (CVT 1113) and Cardiovascular Anatomy and Physiology (CVT 1214)

Competencies and Suggested Objectives	
1.	Discuss pharmacology and its basic components. <ul style="list-style-type: none"> a. Define absorption, distribution, metabolism, and excretion. b. Define half-life. c. Identify factors influencing dosing schedules. d. Explain factors that affect how drugs act on the target tissue. e. Explain how receptors work. f. Define antagonist and agonist reactions. g. Explain factors that may influence a drug's therapeutic response. h. Explain factors that may contribute to toxicity. i. Describe the difference between interactions and incompatibilities.
2.	Demonstrate basic knowledge of analgesics, anesthetics, and narcotics and their relationship to cardiovascular technology. <ul style="list-style-type: none"> a. Define controlled substance. b. Identify the actions of each medication. c. Identify the appropriate uses of each medication as they pertain to the cardiac cath lab. d. State the appropriate doses of the medications. e. Explain the contraindications, adverse reactions, and side effects of each medication. f. Identify the actions of the reversal agents and which medications they reverse. g. Identify the appropriate monitoring necessary to provide safe patient care when administering controlled substances.
3.	Discuss the classification of drugs known as antiarrhythmics and their effects on the cardiovascular system. <ul style="list-style-type: none"> a. Identify the mechanism of action and indication for treatment of each class of antiarrhythmics. b. Explain the actions and uses of antiarrhythmics. c. Identify the contraindications and adverse reactions of the medications. d. Identify the appropriate dose of each antiarrhythmic. e. Explain the appropriate administration of medications.
4.	Discuss the classification of drugs known as hypertensives and their effects on the circulatory system. <ul style="list-style-type: none"> a. Discuss the hypertension and the differences among primary, malignant, and secondary

<p>hypertension.</p> <ul style="list-style-type: none"> b. Describe the risks of hypertension. c. Define the treatments for hypertension. d. Describe how beta blockers, ace inhibitors, and calcium channel blockers work. e. Summarize the actions of each medication. f. Discuss the contraindications, side effects, and possible adverse reactions to all medications. g. Identify the normal dose of medications and how they are correctly administered.
<p>5. Identify the major cardiac stimulants and their actions on the myocardium.</p> <ul style="list-style-type: none"> a. Identify the mechanism each medication used to increase myocardial contractility. b. Identify the appropriate uses of each medication. c. Discuss the situations when each medication is contraindicated. d. Discuss possible adverse reactions to each medication and how to avoid them.
<p>6. Demonstrate knowledge of antiangina medications and their relationship to chest pain.</p> <ul style="list-style-type: none"> a. Discuss angina and its causes. b. Define unstable angina. c. Explain the goals of treatment of angina. d. Describe how beta blockers work to relieve angina. e. Describe how calcium channel blockers work to relieve angina. f. Describe how nitrates act to relieve angina. g. <u>Discuss the action, indication, and normal dose for the antianginal medications.</u>
<p>7. Discuss the clinical usage of anticoagulants, antiplatelets, and thrombolytic medications and their effects on the clotting mechanisms of the circulatory system.</p> <ul style="list-style-type: none"> a. Discuss the clotting process and the stimulus for clotting. b. Discuss why a coronary lesion is likely to attract clot after an interventional procedure. c. Explain how the anticoagulant heparin works. d. Describe how GP IIb/IIIa antiplatelet drugs work and how they are used. e. Explain how the oral antiplatelet drugs work. f. Explain how thrombolytic medications work to dissolve clots and how they are used. g. Identify the complications to each drug and how to prevent them. h. Identify the contraindications to each drug.
<p>8. Discuss the classification of drugs known as diuretics and their clinical effectiveness in treating hypertension.</p> <ul style="list-style-type: none"> a. Identify the mechanism involving the renal system that contributes to regulation of blood pressure. b. Describe how diuretics work to treat congestive heart failure. c. Identify the contraindications to diuretics. d. Identify the side effects and possible adverse events that can occur with administration of diuretics. e. Identify the outcomes that demonstrate the therapeutic effects of diuretics.
<p>9. Discuss the diagnostic properties and possible allergic reactions in the use of contrast media.</p> <ul style="list-style-type: none"> a. Discuss the uses, doses, contraindications, side effects, and possible adverse reactions of medications. b. Identify the maximum dose of contrast. c. Discuss the signs and symptoms of a contrast allergy.

d. Identify the medications useful for treating allergic reactions.

STANDARDS

Standards and Guidelines for Cardiovascular Programs

Cardiovascular Credentialing International (CCI), Registered Cardiovascular Invasive Specialist (RCIS) Exam Outline, 2008

- CVT1 Cardiovascular Anatomy and Physiology
- CVT2 Cardiovascular Diseases Pathophysiology
- CVT4 Intervention
- CVT6 Pharmacology
- CVT8 Patient Care and Patient Assessment

Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)

- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
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21st Century Skills

- CS1 Global Awareness
- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

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Course Name: Invasive Cardiology I

Course Abbreviation: CVT 2414

Classification: Vocational–Technical Core

Description: Introduces the students to the specific procedures performed in the cardiac catheterization laboratory and the use of the resulting data for patient diagnosis. Additional topics include aseptic techniques, sterilization, patient assessment, radiography, pharmacology, cardiac wave forms, coronary artery anatomy, equipment and tools utilized in cardiac catheterization, hemodynamic data and analysis, right and left heart caths, and complications and treatment of cardiac catheterization. (4 sch: 3-hr lecture, 2-hr lab)

Prerequisites: Foundations of Cardiovascular Technology (CVT 1113), Cardiovascular Anatomy and Physiology (CVT 1214), and Cardiovascular Pharmacology (CVT 1312)

Competencies and Suggested Objectives

1. Demonstrate knowledge of sterilization principles and sterile technique.
 - a. Define and differentiate between the terms “sterile” and “aseptic.”
 - b. Describe and perform sterile technique as related to cardiac catheterization.
 - c. Explain the three major types of sterilization processes.
 - d. List and describe the sterilization equipment and supplies utilized in the cath lab.
 - e. Discuss the topics of infection, infectious diseases, and infection control.
2. Discuss and perform patient assessment as it relates to cardiac catheterization.
 - a. Demonstrate how to obtain vital information from the patient as well as the patient’s medical folder.
 - b. Summarize the various components that make up an adequate patient assessment and the importance of each.
 - c. Demonstrate cardiac and peripheral auscultation and their importance in patient assessment.
3. Demonstrate knowledge of radiology and radiography in relation to cardiovascular technology.
 - a. Discuss briefly X-ray theory and its origins, systems, and safety.
 - b. Discuss X-ray techniques and patient positioning.
 - c. Identify the role radiography has in cardiac catheterization.
 - d. Identify radiological equipment and supplies utilized in the cath lab.
 - e. List the associated risks to patient and technician associated with radiation and contrast media exposure.
 - f. Discuss cine film and film processing.
 - g. Discuss the digitalization process now being employed by the cardiac catheterization industry.
4. Discuss basic pharmacology as related to cardiac catheterization.
 - a. Identify examples of the various classifications of cardiac medication.
 - b. Demonstrate basic knowledge of beta blockers, antiarrhythmics, calcium and sodium channel blockers, analgesics, anticoagulants, diuretics, cardiotonics, analgesics, and platelet inhibitors and thrombolytics.

<p>c. Identify emergency drugs located in the emergency crash cart.</p> <p>d. List the various routes of administration.</p>
<p>5. Demonstrate knowledge of the various cardiac wave forms that may be encountered in the cath lab.</p> <ol style="list-style-type: none"> Identify the components of a cardiac wave form. Explain which cardiac wave forms are associated with which cardiac disease or abnormality. Differentiate between cardiac wave form abnormality and artifact or interference.
<p>6. Identify all major coronary arteries and their locations.</p> <ol style="list-style-type: none"> List all of the major coronary arteries and their locations. List all of the major coronary veins and their locations. Distinguish between antegrade and retrograde blood flow directions. Define CAD (coronary artery disease) and its effects on the American population.
<p>7. Discuss the importance of hemodynamic data analysis.</p> <ol style="list-style-type: none"> Describe the various forms of cardiovascular hemodynamics. List the five pressure readings obtained by the Swan-Ganz pulmonary artery catheter and the importance of each. Define hemodynamic terms. Explain the formulas for obtaining cardiac output, cardiac index, stroke volume index, right ventricular stroke work index, peripheral vascular resistance, and systemic vascular resistance.
<p>8. Discuss in detail the cardiac catheterization tools and equipment found in the cath lab.</p> <ol style="list-style-type: none"> Identify and explain the use of the fluoroscope, physiologic recorder, contrast power injector, and patient table. List the common items and supplies found in the cat lab crash cart. Discuss the team approach to cardiac catheterization. Identify the members that make up a cardiac cath team and the responsibility of each.
<p>9. Describe and discuss cardiac catheterization techniques involving right and left heart cath procedures.</p> <ol style="list-style-type: none"> Describe and explain a right heart catheterization procedure. List the various cardiomyopathies that may require a right heart cath procedure. List the various catheter types and supplies that may be required in a right heart cath procedure. Describe and explain a left heart catheterization and procedure. List the various cardiomyopathies that may require a left heart cath procedure. List the various catheter types and supplies that may be required in a left heart procedure.

STANDARDS

Standards and Guidelines for Cardiovascular Programs

Cardiovascular Credentialing International (CCI), Registered Cardiovascular Invasive Specialist (RCIS) Exam Outline, 2008

CVT1 Cardiovascular Anatomy and Physiology

Postsecondary Cardiovascular Technology

- CVT2 Cardiovascular Diseases Pathophysiology
- CVT3 Diagnostic Techniques
- CVT4 Intervention
- CVT5 Hemodynamic Data
- CVT6 Pharmacology
- CVT7 Equipment and Instrumentation
- CVT8 Patient Care and Patient Assessment

Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
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- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
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- A6 Geometry (angles, Pythagorean theory)
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- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
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21st Century Skills

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- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
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Venes, D. (2005). *Taber's cyclopedic medical dictionary* (20th ed.). Philadelphia, PA: F. A. Davis Company.

Course Name: Invasive Cardiology II

Course Abbreviation: CVT 2424

Classification: Vocational–Technical Core

Description: This course is designed to tie together cardiac diseases as well as to continue teaching the students classifications and the use of equipment and techniques used in invasive cardiology. An in-depth presentation of various cardiac diseases including coronary artery disease, angina, myocardial infarction, heart failure, valve diseases, cardiomyopathies, pericardial disorders, arrhythmias, congenital anomalies, and repair procedures is used. Additionally, students will learn the various calculations performed in the cath lab including cardiac outputs, vascular resistance, valve areas, and shunts. (4 sch: 3-hr lecture, 2-hr lab)

Prerequisites: Invasive Cardiology I (CVT 2414)

Competencies and Suggested Objectives

1. Demonstrate extensive knowledge of cardiovascular conditions and diseases.
 - a. Discuss the general description, etiology, pathogenesis, clinical manifestations including patient presentation, EKG, stress and cardiac cath findings, detailed hemodynamic and angiographic findings, and laboratory values including but not limited to the following cardiac diseases:
 - (1) Coronary artery disease
 - (2) Atherosclerosis thrombus formation
 - (3) Restenosis after angioplasty
 - (4) Stable angina
 - (5) Unstable angina
 - (6) Prinzmetal's or variant angina
 - (7) Acute myocardial infarction
 - (8) Right side heart failure
 - (9) Left side heart failure
 - (10) Dilated cardiomyopathy
 - (11) Hypertrophic cardiomyopathy with and without obstruction
 - (12) Restrictive cardiomyopathy
 - (13) Myocarditis
 - (14) Endocarditis
 - (15) Pericarditis
 - (16) Pericardial disorders and effusion
 - (17) Constrictive pericarditis
 - (18) Cardiac tamponade
 - (19) Aortic stenosis and insufficiency
 - (20) Mitral stenosis and insufficiency
 - (21) Pulmonary stenosis and insufficiency
 - (22) Bicuspid stenosis and insufficiency
 - (23) Various congenital anomalies
 - (24) Patent ductus arteriosus

- (25) Artrial septal defect
- (26) Ventricular septal defect
- (27) Truncus arteriosus
- (28) Bicuspid aortic valve
- (29) Coarctation of the aorta
- (30) Tetrology of Fallot
- (31) Transposition of the great vessels
- (32) Bicuspid atresia
- (33) Anomalous venous return
- (34) Kawasaki's disease
- (35) Ebstein's anomaly
- (36) Aortic dissection and aneurysm

b. Discuss the treatments of the following cardiac diseases:

- (1) Coronary artery disease
- (2) Atherosclerosis thrombus formation
- (3) Restenosis after angioplasty
- (4) Stable angina
- (5) Unstable angina
- (6) Prinzmetal's or variant angina
- (7) Acute myocardial infarction
- (8) Right side heart failure
- (9) Left side heart failure
- (10) Dilated cardiomyopathy
- (11) Hypertrophic cardiomyopathy with and without obstruction
- (12) Restrictive cardiomyopathy
- (13) Myocarditis
- (14) Endocarditis
- (15) Pericarditis
- (16) Pericardial disorders and effusion
- (17) Constrictive pericarditis
- (18) Cardiac tamponade
- (19) Aortic stenosis and insufficiency
- (20) Mitral stenosis and insufficiency
- (21) Pulmonary stenosis and insufficiency
- (22) Bicuspid stenosis and insufficiency
- (23) Various congenital anomalies
- (24) Patent ductus arteriosus
- (25) Artrial septal defect
- (26) Ventricular septal defect
- (27) Truncus arteriosus
- (28) Bicuspid aortic valve
- (29) Coarctation of the aorta
- (30) Tetrology of Fallot
- (31) Transposition of the great vessels
- (32) Bicuspid atresia
- (33) Anomalous venous return

<ul style="list-style-type: none"> (34) Kawasaki's disease (35) Ebstein's anomaly (36) Aortic dissection and aneurysm
<p>2. Demonstrate cardiovascular hemodynamic knowledge as it relates to the cath-lab environment.</p>
<p>a. Perform the following calculations, and know the normal values of the following:</p> <ul style="list-style-type: none"> (1) Mean arterial pressure (2) Cardiac output (3) Fick method (4) Thermodilution method (5) Angiography method (6) Green dye method (7) Cardiac index (8) Ejection fraction (9) Regurgitated fractions (10) Systemic and pulmonary vascular resistance (11) Systolic ejection period (12) Diastolic filling period (13) Valve area calculation (Gorlin formula) (14) Shunts—right to left, left to right (15) Systemic blood flow (SBF) (16) Pulmonic blood flow (PBF) (17) Shunt ratio (Qp:Qs) (18) Percent shunt (19) Absolute shunt
<p>b. Identify the implications and treatments for the abnormal values of the following:</p> <ul style="list-style-type: none"> (1) Mean arterial pressure (2) Cardiac output (3) Fick method (4) Thermodilution method (5) Angiography method (6) Green dye method (7) Cardiac index (8) Ejection fraction (9) Regurgitated fractions (10) Systemic and pulmonary vascular resistance (11) Systolic ejection period (12) Diastolic filling period (13) Valve area calculation (Gorlin formula) (14) Shunts—right to left, left to right (15) Systemic blood flow (SBF) (16) Pulmonic blood flow (PBF) (17) Shunt ratio (Qp:Qs) (18) Percent shunt (19) Absolute shunt
<p>3. Demonstrate advanced knowledge of common cardiac medications and IV therapy.</p>

<ul style="list-style-type: none"> a. Identify the indications, contraindications, actions, risks, benefits, and dosages of commonly used cardiac medications. b. Identify drug calculations of commonly used cardiac medications.
<ul style="list-style-type: none"> 4. Demonstrate knowledge of cardiac pacemakers and defibrillators. <ul style="list-style-type: none"> a. Discuss the indications, coding, setup, and troubleshooting of cardiac pacemakers. b. Discuss the indications, coding, setup, and troubleshooting of automatic implantable cardioverter defibrillators (AICDs).
<ul style="list-style-type: none"> 5. Demonstrate knowledge of an electrophysiology study as it relates to cardiovascular technology. <ul style="list-style-type: none"> a. Discuss the indications, risks, benefits, equipment utilized, and data obtained in an electrophysiology study (EPS). b. Discuss the use of radio frequency ablation and cryo-therapy techniques frequently used in electrophysiology studies.

STANDARDS

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CVT1	Cardiovascular Anatomy and Physiology
CVT2	Cardiovascular Diseases Pathophysiology
CVT3	Diagnostic Techniques
CVT4	Intervention
CVT5	Hemodynamic Data
CVT6	Pharmacology
CVT7	Equipment and Instrumentation
CVT8	Patient Care and Patient Assessment

Related Academic Standards

R1	Interpret Graphic Information (forms, maps, reference sources)
R2	Words in Context (same and opposite meaning)
R3	Recall Information (details, sequence)
R4	Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5	Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
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M2	Subtraction of Whole Numbers (no regrouping, regrouping)
M3	Multiplication of Whole Numbers (no regrouping, regrouping)
M4	Division of Whole Numbers (no remainder, remainder)
M5	Decimals (addition, subtraction, multiplication, division)
M6	Fractions (addition, subtraction, multiplication, division)
M7	Integers (addition, subtraction, multiplication, division)
M8	Percents

- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
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- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
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Course Name: Critical Care Application

Course Abbreviation: CVT 2512

Classification: Vocational–Technical Core

Description: This course is designed to familiarize students with characteristics of critically ill cardiopulmonary patients and specific needs of such patients in relation to their particular illnesses. Patient case studies will be presented for student discussion and will address the specific diagnostic and therapeutic modalities available to the cardiovascular patient for palliative and corrective results. (2 sch: 2-hr lecture)

Prerequisites: Invasive Cardiology I (CVT 2414) or Non-Invasive Cardiology I (CVT 2614) and Cardiovascular Clinical I (CVT 2716)

Competencies and Suggested Objectives	
1.	Properly assess the patient's overall clinical condition. <ol style="list-style-type: none"> Detect, discuss, and differentiate among the study patient's anomalous cardiovascular signs and symptoms according to the information presented in the patient case study. Determine a tentative diagnosis of a critically ill patient according to the information presented in the patient study.
2.	Determine the proper diagnostic and therapeutic treatment plan for the patient. <ol style="list-style-type: none"> Explain in detail the sequential steps of the diagnostic and therapeutic treatments as prescribed for the study patient. Compare and contrast the terms diagnostic and therapeutic in relation to cardiovascular technology and cardiac catheterization procedures.
3.	Discuss the probable prognosis of the patient according to the information presented in the patient case study. <ol style="list-style-type: none"> Define the medical term prognosis. Compare and contrast the term prognosis with the term diagnosis.
4.	List and discuss preventative measures, if any, of the patient's clinical diagnosis. <ol style="list-style-type: none"> List several types of preventative measures in combating coronary artery disease. List several types of genetic predispositions that may influence the onset of cardiovascular disorders.
5.	Discuss any recent relevant information, clinical studies, clinical trials, news articles, and publications concerning the patient's condition and/or disease according to the information presented in the patient case studies. <ol style="list-style-type: none"> Select two topics, and give an oral presentation to the class regarding a condition or disease previously mentioned in a recent case study. Provide case studies of anonymous patients.
6.	Define the five basic steps of research. <ol style="list-style-type: none"> Define the term problem as it relates to research. Define the terms hypothesis and hypothesis testing as they relate to research. Define the basic step collection of data as it relates to research. Define the basic step interpretation of data as it relates to research. Define the terms summary and discussion as they relate to research.

7. Discuss various statistical methods.
a. Define the term mean as it relates to statistical research.
b. Define the term median as it relates to statistical research.
c. Define the term mode as it relates to statistical research.
d. List and discuss the measures of central tendency.
e. Discuss various research and study designs.
8. Perform a research project.
a. Identify trends in the cardiovascular technology industry.
b. Present a research paper.

STANDARDS

Standards and Guidelines for Cardiovascular Programs

Cardiovascular Credentialing International (CCI), Registered Cardiovascular Invasive Specialist (RCIS) Exam Outline, 2008

CVT1	Cardiovascular Anatomy and Physiology
CVT2	Cardiovascular Diseases Pathophysiology
CVT3	Diagnostic Techniques
CVT4	Intervention
CVT5	Hemodynamic Data
CVT6	Pharmacology
CVT7	Equipment and Instrumentation
CVT8	Patient Care and Patient Assessment

Related Academic Standards

R1	Interpret Graphic Information (forms, maps, reference sources)
R2	Words in Context (same and opposite meaning)
R3	Recall Information (details, sequence)
R4	Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5	Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1	Addition of Whole Numbers (no regrouping, regrouping)
M2	Subtraction of Whole Numbers (no regrouping, regrouping)
M3	Multiplication of Whole Numbers (no regrouping, regrouping)
M4	Division of Whole Numbers (no remainder, remainder)
M5	Decimals (addition, subtraction, multiplication, division)
M6	Fractions (addition, subtraction, multiplication, division)
M7	Integers (addition, subtraction, multiplication, division)
M8	Percents
M9	Algebraic Operations
A1	Numeration (ordering, place value, scientific notation)
A2	Number Theory (ratio, proportion)

- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
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21st Century Skills

- CS1 Global Awareness
- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
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- CS6 Interpersonal and Self-Directional Skills

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Course Name: Non-Invasive Cardiology I

Course Abbreviation: CVT 2614

Classification: Vocational–Technical Core

Description: An introduction to noninvasive cardiology and those tests performed in this area. In addition, normal and abnormal heart rhythm and patient safety are presented along with stress tests, Holter monitoring, and an introduction in echocardiography. (4 sch: 3-hr lecture, 2-hr lab)

Prerequisites: Foundations of Cardiovascular Technology (CVT 1113), Cardiovascular Anatomy & Physiology (CVT 1214), and Cardiovascular Pharmacology (CVT 1312)

Competencies and Suggested Objectives

1. Demonstrate knowledge of cardiovascular anatomy and physiology.
 - a. Describe the anatomy of the cardiac chambers, valves, supporting structures, and conduction system.
 - b. Describe the function of the cardiac chambers, valves supporting structures, and conduction system.
2. Demonstrate knowledge of the fundamentals of electrocardiography by performing a normal electrocardiogram procedure.
 - a. Describe the theory of rationale for and perform an electrocardiogram.
 - b. Perform technically satisfactory 12-lead electrocardiograms.
 - c. Perform all standard calculations used in electrocardiography.
 - d. Correlate the mechanical action of the heart to the electrical activity.
 - e. Correlate the mechanical action of the heart to the electrical activity.
 - f. Describe the three planes of electrical activity in the heart.
3. Interpret and understand the results of a normal electrocardiogram.
 - a. Identify time and voltage measurement on EKG paper.
 - b. Describe the electromechanical activity of the heart in relation to normal wave deflection.
 - c. Define terms associated with the electrocardiogram.
 - d. Calculate a heart rate from an EKG tracing.
 - e. Perform and understand basic principles involved in electrocardiography.
 - f. Discuss the effect of the autonomic nervous system on the SA node.
4. Interpret and understand the results of an abnormal electrocardiogram.
 - a. Explain the differences between electrocardiogram abnormalities and artifact due to electro-mechanical interference.
 - b. Adequately “troubleshoot” the equipment used in order to obtain the highest quality EKGs possible.
 - c. Demonstrate knowledge in the operation of the equipment used to obtain an EKG.
 - d. Interpret and understand the major cardiac rhythm disturbances and other abnormal patterns including axis deviation, chamber enlargement and hypertrophy, bundle branch block, ischemia, injury, and infarction as seen by 12-lead electrocardiography.
 - e. Interpret and understand the major abnormal patterns obtained by the EKG.
5. Discuss the various stress tests used to interpret the cardiovascular condition of a patient.

<ul style="list-style-type: none"> a. Identify three types of stress tests. b. Discuss patient preparation in preparing for a stress test. c. List the diagnostic aspects of a stress test. d. Discuss the procedural steps involved in a stress test. e. List four factors that can relatively affect the quality and performance of a stress test. f. Discuss recent research conducted by the American Heart Association regarding stress tests.
<ul style="list-style-type: none"> 6. Explain the advantages of Holter monitoring and its usefulness in diagnosing cardiac abnormalities. <ul style="list-style-type: none"> a. Define the term Holter monitoring. b. Explain the patient preparation for use of the Holter monitor. c. List the additional tests that may be ordered after Holter monitor results are analyzed. d. Compare and contrast the Holter monitor with the event recorder.
<ul style="list-style-type: none"> 7. Summarize the role of echocardiography in relation to cardiovascular technology. <ul style="list-style-type: none"> a. Define the term echocardiography. b. Discuss the underlying principles of cardiovascular sonography. c. List the procedural steps in obtaining an accurate echocardiogram. d. Explain the future role of echocardiography as a noninvasive methodology of choice among cardiologists. e. Briefly describe the diagnostic advantages and disadvantages of echocardiography.

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R3	Recall Information (details, sequence)
R4	Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5	Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1	Addition of Whole Numbers (no regrouping, regrouping)

Postsecondary Cardiovascular Technology

- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
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- L1 Usage (pronoun, tense, subject-verb agreement, adjective, adverb)
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Course Name: Non-Invasive Cardiology II

Course Abbreviation: CVT 2624

Classification: Vocational–Technical Core

Description: This course is designed to be a continuation of Non-Invasive Cardiology I. More in-depth study is completed in the area of noninvasive cardiac testing, and a greater view of echocardiography is presented. A firm didactic foundation of echocardiography is presented with provisions available for further study of techniques including 2-D, M-Mode, continuous, pulse wave, and color Doppler techniques. (4 sch: 3-hr lecture, 2-hr lab)

Prerequisites: Non-Invasive Cardiology I (CVT 2614)

Competencies and Suggested Objectives	
1.	Identify and describe the anatomical structures of the heart and great vessels utilizing echocardiography. <ul style="list-style-type: none"> a. Recognize the four cardiac chambers. b. Identify the following great vessels: <ul style="list-style-type: none"> (1) Aorta (2) Superior Vena Cavae (3) Inferior Vena Cavae (4) Pulmonary Artery Trunk
2.	Describe the physiological function of the chambers of the heart, valves, and supporting structures and the great vessels. <ul style="list-style-type: none"> a. Identify the individual functions of the four cardiac chambers. b. List and identify the four cardiac valves. c. Identify the chordae tendinae and papillary muscles of a cardiac valve. d. Describe the main function of the aorta, pulmonary artery trunk, IVC, and SVC.
3.	List normal intracardiac pressure values for the chambers of the heart and great vessels. <ul style="list-style-type: none"> a. State the normal intravascular pressure of the superior vena cavae. b. State the normal intracardiac pressure of the right ventricle. c. State the normal intravascular pressure of the pulmonary artery trunk. d. State the normal intracardiac pressure of the left atrium. e. State the normal intracardiac pressure of the left ventricle. f. State the normal intravascular pressure of the aorta.
4.	Recognize and identify hemodynamic pressure curves from the atria, ventricles, and great vessels. <ul style="list-style-type: none"> a. Identify normal hemodynamic pressure curves. b. Identify abnormal hemodynamic pressure curves.
5.	Record factors of pertinent medical history as related to noninvasive diagnostic testing. <ul style="list-style-type: none"> a. Record all patients' vital signs. b. Record all patients' known allergies including drug allergies. c. Record all patients' allergies in red ink.
6.	Conduct a limited physical examination, and recognize certain cardiovascular disorders. <ul style="list-style-type: none"> a. Identify auscultate heart sounds.

b. Identify murmurs if present.
c. Identify auscultate carotid arteries.
d. Note any bruits.
e. Examine all limbs, and auscultate pedal pulses for evidence of peripheral vascular disease.
7. Properly use a stethoscope in recognition/evaluation of normal heart sounds.
a. Relate the heart sounds to hemodynamic events occurring within the cardiovascular system.
b. Differentiate between normal and abnormal cardiac auscultation.
8. Recognize cardiac murmurs, and relate these murmurs to specific pathological conditions of the heart.
a. Identify systolic murmurs.
b. Identify diastolic murmurs.
9. Utilize the echocardiograms to measure valve leaflet excursion/velocity, wall thickness, and chamber dimension.
a. Measure ejection velocity of tricuspid valve.
b. Measure ejection velocity of pulmonic valve.
c. Measure ejection velocity of mitral valve.
d. Measure ejection velocity of aortic valve.
10. Utilize the echocardiogram to recognize various basic pathological conditions.
a. Identify mitral stenosis.
b. Identify mitral prolapse.
c. Identify aortic stenosis.
d. Identify pulmonic stenosis.
e. Identify tricuspid stenosis.
11. Distinguish between the various modes used in echocardiography.
a. Identify 2-D mode.
b. Identify M-mode.
c. Identify Doppler mode.
12. Distinguish between the two colors used in Doppler echocardiography.
a. State the significance of the color red utilized in Doppler echocardiography.
b. State the significance of the color blue utilized in Doppler echocardiography.

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Course Name: Cardiovascular Clinical I

Course Abbreviation: CVT 2716

Classification: Vocational–Technical Core

Description: Patient assessment and care plan formation are presented in the hospital environment. Clinical experience in all procedures performed in the cardiovascular laboratories, including use of equipment, performing tests, and patient care as it relates to the cardiovascular areas with emphasis on cardiac catheterization, ECG, stress testing, Holter monitoring, and introduction to echocardiography. (6 sch: 18-hr clinical)

Prerequisites: Foundations of Cardiovascular Technology (CVT 1113), Cardiovascular Anatomy and Physiology (CVT 1214), and Cardiovascular Pharmacology (CVT 1312), Current American Heart Association BLS

Competencies and Suggested Objectives

1. Develop the appropriate psychomotor clinical skills as they relate to cardiovascular technology.
 - a. Observe and practice the skills required to function in all aspects in the cardiac cath lab in the appropriate time frame as indicated on the clinical checklist including the following:
 - (1) Patient transport
 - (2) Knowledge of department policies and procedures
 - (3) Holding area, pre and post cath
 - (4) X-ray positioning—manipulation of the imaging equipment and film development
 - (5) Scrubbing position
 - (6) Circulating position
 - (7) Physiologic monitoring/recording position
2. Develop the appropriate clinical and cognitive knowledge as it relates to cardiovascular technology.
 - a. Observe and practice the clinical and cognitive skills required to function in all aspects in the noninvasive cardiology department in the appropriate time frame as indicated on the clinical skills checklist including the following:
 - (1) EKG department
 - (2) Holter monitoring
 - (3) Stress testing
 - (4) Echocardiography laboratories
 - b. Demonstrate the clinical and cognitive skills required to function in all aspects in the noninvasive cardiology department in the appropriate time frame as indicated on the clinical skills checklist including the following:
 - (1) EKG department
 - (2) Holter monitoring
 - (3) Stress testing
 - (4) Echocardiography laboratories

3.	Demonstrate the application of basic CPR.
a.	Complete the American Heart Association program - Basic Cardiac Life Support.
b.	Exhibit correct one person CPR technique.
c.	Exhibit correct two person CPR technique.
d.	React to a clinical situation during CPR.
e.	Exhibit correct techniques with a manual resuscitation bag.
f.	Troubleshoot a resuscitation bag in the event of malfunction.
4.	Demonstrate knowledge of protective and reverse isolation.
a.	Identify the correct protective and reverse isolation procedures and protocols.
b.	Demonstrate the correct protective and reverse isolation procedures and protocols.
5.	Demonstrate interpersonal and affective skills with clinical affiliates.
a.	Demonstrate skills within the department.
b.	Demonstrate using effective telephone etiquette.
c.	Demonstrate correct charge and record keeping procedures.
d.	Follow policy and procedures manual.
6.	Demonstrate knowledge of equipment used in the cath lab environment.
a.	Demonstrate equipment assembly and disassembly.
b.	Demonstrate equipment acquisition, setup, and cleaning.
7.	Obtain patient vital signs.
a.	Identify the steps in taking a patient's temperature, pulse, respiration, and blood pressure.
b.	Practice taking temperature, pulse, respiration, and blood pressure.
8.	Demonstrate appropriate charting.
a.	Identify the different sections that make up a patient's chart.
b.	Record all entries accurately and neatly.
c.	Explain the chart significance as a legal document.
d.	Clarify symbols and figures used for chart entries.
9.	Observe professional communication in a cath lab/hospital environment.
a.	Communicate and interact effectively with the primary physician and all medical staff.
b.	Communicate and interact effectively with nursing staff and other allied health professionals.
c.	Communicate effectively with patients and family members.

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Course Name: Cardiovascular Clinical II

Course Abbreviation: CVT 2728

Classification: Vocational–Technical Core

Description: This course is designed for students to gain more in-depth clinical experience in invasive cardiology including pre and post cath activities, cardiovascular techniques, hemodynamic monitoring, intra-aortic balloon pump, and cardiac output measurements. Clinical practice in the cardiac catheterization lab includes circulating, scrubbing, recoding, and manipulating the imaging equipment during both diagnosis and interventional catheterization procedures. (8 sch: 24-hr clinical)

Prerequisites: Cardiovascular Clinical I (CVT 2716)

Competencies and Suggested Objectives	
1.	Refine the appropriate psychomotor clinical skills as they relate to cardiovascular technology. <ul style="list-style-type: none"> a. Demonstrate the skills required to function in all aspects in the cardiac cath lab in the appropriate time frame as indicated on the clinical checklist including the following: <ul style="list-style-type: none"> (1) Patient transport (2) Knowledge of department policies and procedures (3) Holding area, pre and post cath (4) X-ray positioning—manipulation of the imaging equipment and film development (5) Scrubbing position (6) Circulating position (7) Physiologic monitoring/recording position
2.	Refine the clinical and cognitive knowledge as it relates to cardiovascular technology. <ul style="list-style-type: none"> a. Demonstrate the clinical and cognitive skills required to function in all aspects in the noninvasive cardiology department in the appropriate time frame as indicated on the clinical skills checklist including the following: <ul style="list-style-type: none"> (1) EKG department (2) Holter monitoring (3) Stress testing (4) Echocardiography laboratories
3.	Participate in the application of basic CPR. <ul style="list-style-type: none"> a. Complete American Heart Association program - Basic Cardiac Life Support. b. Exhibit correct one person CPR technique. c. Exhibit correct two person CPR technique. d. React to a given clinical situation during CPR. e. Exhibit correct techniques with a manual resuscitation bag. f. Troubleshoot a resuscitation bag in the event of malfunction.
4.	Practice protective and reverse isolation. <ul style="list-style-type: none"> a. Identify the steps in protective and reverse isolation procedures and protocols. b. Demonstrate the steps in protective and reverse isolation procedures and protocols.

5. Practice interpersonal and affective skills with clinical affiliates.
a. Demonstrate skills within the department.
b. Demonstrate using effective telephone etiquette.
c. Demonstrate correct charge and record keeping procedures.
d. Follow policy and procedures manual.
6. Practice knowledge of equipment used in the cath lab environment.
a. Demonstrate equipment assembly and disassembly.
b. Demonstrate equipment acquisition, setup, and cleaning.
7. Discuss types of sterilization and cleaning used in clinical affiliates.
a. Discuss knowledge chemical, gas, and steam autoclave sterilization and cleaning.
b. Discuss the pasteurization, respective time, concentration, and temperature of each method.
8. Continue to practice obtaining patient vital signs.
9. Practice appropriate charting.
10. Demonstrate professional communication in a cath lab/hospital environment.
a. Communicate and interact effectively with the primary physician and all medical staff.
b. Communicate and interact effectively with nursing staff and other allied health professionals.
c. Communicate effectively with patients and family members.

STANDARDS

Standards and Guidelines for Cardiovascular Programs

Cardiovascular Credentialing International (CCI), Registered Cardiovascular Invasive Specialist (RCIS) Exam Outline, 2008

CVT1	Cardiovascular Anatomy and Physiology
CVT2	Cardiovascular Diseases Pathophysiology
CVT3	Diagnostic Techniques
CVT4	Intervention
CVT5	Hemodynamic Data
CVT6	Pharmacology
CVT7	Equipment and Instrumentation
CVT8	Patient Care and Patient Assessment

Related Academic Standards

R1	Interpret Graphic Information (forms, maps, reference sources)
R2	Words in Context (same and opposite meaning)
R3	Recall Information (details, sequence)
R4	Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5	Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1	Addition of Whole Numbers (no regrouping, regrouping)
M2	Subtraction of Whole Numbers (no regrouping, regrouping)

- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject-verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
- S3 Structural Unit (root, suffix)

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21st Century Skills

- CS1 Global Awareness
- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

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Venes, D. (2005). *Taber's cyclopedic medical dictionary* (20th ed.). Philadelphia, PA: F. A. Davis Company.

Course Name: Cardiovascular Clinical III

Course Abbreviation: CVT 2738

Classification: Vocational–Technical Core

Description: Designed for students to gain additional clinical experience and polish their skills in the cath lab performing all duties involved in diagnostic and interventional cases. (8 sch: 24-hr clinical)

Prerequisites: Cardiovascular Clinical II (CVT 2728)

Competencies and Suggested Objectives	
1.	<p>Demonstrate mastery of the appropriate skills as detailed on the clinical skills checklists.</p> <p>a. Observe and practice the skills required to function in all aspects in the cardiac cath lab in the appropriate time frame as indicated on the clinical checklist including the following:</p> <ul style="list-style-type: none"> (1) Patient transport (2) Knowledge of department policies and procedures (3) Holding area, pre and post cath (4) X-ray positioning—manipulation of the imaging equipment and film development. (5) Scrubbing position (6) Circulating position (7) Physiologic monitoring/recording position <p>b. Demonstrate mastery of the skills required to function in all aspects in the cardiac cath lab in the appropriate time frame as indicated on the clinical checklist including the following:</p> <ul style="list-style-type: none"> (1) Patient transport (2) Knowledge of department policies and procedures (3) Holding area, pre and post cath (4) X-ray positioning—manipulation of the imaging equipment and film development (5) Scrubbing position (6) Circulating position (7) Physiologic monitoring/recording position
2.	<p>Discuss the complete process of cleaning and sterilization, from breakdown to packaging.</p> <p>a. Assemble and disassemble equipment.</p> <p>b. Determine the appropriate and preferred method of sterilization.</p> <p>c. Clean equipment before it is sterilized (if necessary).</p> <p>d. Briefly describe the following methods of sterilization:</p> <ul style="list-style-type: none"> (1) Autoclave (2) Ethylene oxide (3) Glutaraldehyde <p>e. Demonstrate knowledge of the following quantitative factors for each of the above methods of sterilization concerning:</p>

<ul style="list-style-type: none"> (1) Time (2) Concentration (3) Temperature
<p>3. Demonstrate knowledge of emergency equipment that may be in the hospital during an emergency situation.</p> <ul style="list-style-type: none"> a. Demonstrate how to maintain an adequate airway. b. Demonstrate how to properly defibrillate a patient. c. Demonstrate how to properly administer medication.
<p>4. Acquire and develop the appropriate clinical and cognitive knowledge as it relates to cardiovascular technology.</p> <ul style="list-style-type: none"> a. Observe and practice the clinical and cognitive skills required to function in all aspects in the noninvasive cardiology department in the appropriate time frame as indicated on the clinical skills checklist including the following: <ul style="list-style-type: none"> (1) EKG department (2) Holter monitoring (3) Stress testing (4) Echocardiography lab b. Demonstrate the clinical and cognitive skills required to function in all aspects in the noninvasive cardiology department in the appropriate time frame as indicated on the clinical skills checklist including the following: <ul style="list-style-type: none"> (1) EKG department (2) Holter monitoring (3) Stress testing (4) Echocardiography lab
<p>5. Demonstrate knowledge and theory of the use of the intra-aortic balloon pump.</p> <ul style="list-style-type: none"> a. Adequately state the theory behind the use of the IABP. b. Correctly set up an IABP. c. Demonstrate the ability to monitor an IABP. d. Troubleshoot an IABP.
<p>6. Apply hemodynamic monitoring principles and calculation.</p> <ul style="list-style-type: none"> a. Perform thermodilution cardiac outputs. b. Perform angiographic cardiac outputs. c. Perform Fick cardiac outputs.
<p>7. Draw blood from an arterial line and catheters.</p> <ul style="list-style-type: none"> a. Properly shut off stopcocks. b. Utilize sterile technique. c. Properly reopen closed off stopcocks. d. Watch for and prevent air bubbles. e. Re-zero arterial line if necessary.
<p>8. Perform calculations common to the cath lab.</p> <ul style="list-style-type: none"> a. Calculate vascular resistance. b. Calculate ejection fraction. c. Calculate valve areas d. Calculate shunts.
<p>9. Demonstrate mastery of obtaining patient vital signs.</p> <ul style="list-style-type: none"> a. Obtain a patient's temperature.

<ul style="list-style-type: none"> b. Determine a patient's pulse. c. Calculate a patient's respiration rate. d. Properly obtain a patient's blood pressure.
10. Continue to demonstrate appropriate charting. <ul style="list-style-type: none"> a. Identify the different sections that make up a patient's chart. b. Record all entries accurately and neatly. c. Explain the chart significance as a legal document. d. Clarify symbols and figures used for chart entries. e. Properly demonstrate correcting a mistake on a patient's chart.
11. Utilize interpersonal and effective skills with clinical affiliates. <ul style="list-style-type: none"> a. Demonstrate knowledge of department locations. b. Utilize professional telephone etiquette. c. Demonstrate familiarization with charge and record keeping procedures. d. Demonstrate knowledge of departmental policy and procedure manuals.
12. Demonstrate knowledge of the American Heart Association guidelines. <ul style="list-style-type: none"> a. Identify cardiac arrest. b. Apply the ABCs of cardiopulmonary resuscitation. c. Identify ventricular tachycardia. d. Identify bradycardia. e. Identify asystole.
13. Apply the principles of ethical behavior to the cath lab environment. <ul style="list-style-type: none"> a. Demonstrate practices that ensure patient confidentiality. b. Demonstrate practices that ensure patient privacy.
14. Demonstrate mastery of professional communication in a cath lab/hospital environment. <ul style="list-style-type: none"> a. Communicate and interact effectively with the primary physician and all medical staff. b. Communicate and interact effectively with nursing staff and other allied health professionals. c. Communicate effectively with patients and family members.

STANDARDS

Standards and Guidelines for Cardiovascular Programs

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Related Academic Standards

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
- S3 Structural Unit (root, suffix)

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21st Century Skills

- CS1 Global Awareness
- CS2 Financial, Economic, and Business Literacy
- CS3 Civic Literacy
- CS4 Information and Communication Skills
- CS5 Thinking and Problem-Solving Skills
- CS6 Interpersonal and Self-Directional Skills

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Venes, D. (2005). *Taber's cyclopedic medical dictionary* (20th ed.). Philadelphia, PA: F. A. Davis Company.

Recommended Tools and Equipment

CAPITALIZED

1. Apron, lead (4 per program)
2. EKG machine, 12 lead (1 per program)
3. EKG hemodynamic waveform simulator (1 per program)
4. Computer (2 per program)
5. Diagnostic imaging system (1 per program)
6. Mannequin, basic weighted (1 per program)
7. Model, heart, 3 dimensional and very detailed (1 per program)
8. Model, heart angioplasty and by-pass (1 per program)
9. Monitor, ambulatory blood pressure
10. Printer, laser (1 per 2 computers)
11. Projector, ciné (1 per program)

NON-CAPITALIZED

1. Catheters, diagnostic (3 of each of the 20 designs per program)
2. Catheters, therapeutic (1 of each of the 5 types per program)
3. Charts, anatomy with tripod (1 set per program)
4. Chart, sequential human anatomy (1 per program)
5. Model, heart electrocardiogram (ECG) (1 per program)
6. Pack, tubing to include tubing, stopcock, manifolds, and transducers (10 per program)
7. Wires, guide (10 per program)

DISPOSABLE

Pack, surgical to include sterile gowns, gloves, masks, shoe covers, patient drapes, and equipment drape (1 per student)

Teacher should have access to the following:

1. Monitor, T.V., 31-in. Color (1 per program)
2. Laptop computer (1 per program)
3. Projector, data (1 per program)
4. Internet access
5. DVD player (1 per program)

Appendix A: Standards and Guidelines for Cardiovascular Technology Programs

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- CVT1 Cardiovascular Anatomy and Physiology
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- CVT3 Diagnostic Techniques
- CVT4 Intervention
- CVT5 Hemodynamic Data
- CVT6 Pharmacology
- CVT7 Equipment and Instrumentation
- CVT8 Patient Care and Patient Assessment

Appendix B: Related Academic Standards¹

Reading

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)

Mathematics Computation

- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations

Applied Mathematics

- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)

Language

- L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)

Spelling

- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
- S3 Structural Unit (root, suffix)

¹ CTB/McGraw-Hill LLC. (1994). *Tests of adult basic education, Forms 7 and 8*. Monterey, CA: Author.
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Appendix C: 21st Century Skills²

CS1 Global Awareness

- Using 21st century skills to understand and address global issues
- Learning from and working collaboratively with individuals representing diverse cultures, religions, and lifestyles in a spirit of mutual respect and open dialogue in personal, work, and community contexts
- Promoting the study of non-English language as a tool for understanding other nations and cultures

CS2 Financial, Economic, and Business Literacy

- Knowing how to make appropriate personal economic choices
- Understanding the role of the economy and the role of business in the economy
- Applying appropriate 21st century skills to function as a productive contributor within an organizational setting
- Integrating oneself within and adapting continually to our nation's evolving economic and business environment

CS3 Civic Literacy

- Being an informed citizen to participate effectively in government
- Exercising the rights and obligations of citizenship at local, state, national, and global levels
- Understanding the local and global implications of civic decisions
- Applying 21st century skills to make intelligent choices as a citizen

CS4 Information and Communication Skills

- Information and media literacy skills: Analyzing, accessing, managing, integrating, evaluating, and creating information in a variety of forms and media; understanding the role of media in society
- Communication skills: Understanding, managing, and creating effective oral, written, and multimedia communication in a variety of forms and contexts

CS5 Thinking and Problem-Solving Skills

- Critical thinking and systems thinking: Exercising sound reasoning in understanding and making complex choices, understanding the interconnections among systems
- Problem identification, formulation, and solution: Ability to frame, analyze, and solve problems
- Creativity and intellectual curiosity: Developing, implementing, and communicating new ideas to others, staying open and responsive to new and diverse perspectives

CS6 Interpersonal and Self-Directional Skills

- Interpersonal and collaborative skills: Demonstrating teamwork and leadership, adapting to varied roles and responsibilities, working productively with others, exercising empathy, and respecting diverse perspectives
- Self-direction: Monitoring one's own understanding and learning needs, locating appropriate resources, and transferring learning from one domain to another
- Accountability and adaptability: Exercising personal responsibility and flexibility in personal, workplace, and community contexts; setting and meeting high standards and goals for one's self and others; and tolerating ambiguity

² 21st century skills. (n.d.). Washington, DC: Partnership for 21st Century Skills.

- Social responsibility: Acting responsibly with the interests of the larger community in mind; demonstrating ethical behavior in personal, workplace, and community contexts